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# Outline

- NTSB Basics
- Some Future Concerns



# NTSB 101

- Independent agency, investigate transportation accidents, all modes
- Determine probable cause(s) and make recommendations to prevent recurrences
- Do not determine blame or liability
- Conduct special studies and investigations
- Assist victims and their families



# Independent

- 5 Members
  - Nominated by President, confirmed by Senate
- Political independence
  - Political party balance
  - Member terms are fixed and staggered
  - Requirement for relevant background, expertise
  - Purpose: Conclusions from facts, not politics
- Functional Independence
  - Not a regulator or operator
  - Purpose: Impartial and unbiased investigations



# Purpose

- Single focus is ***SAFETY***
- Primary product:  
Safety recommendations
- Response to recommendations:  
> 80% acceptable



# Some Future Concerns

- Pilot professionalism
- Criminalization of accidents
- Increasing automation



# Pilot Professionalism

## *Problem*

- Loss of military pilot pipeline
- Military: “Right Stuff” or out

## *Current Civilian System*

- Written test: Knowledge
- Flying test: Skills and knowledge
- *Not tested: Judgment or professionalism*
- *No limit on how many times to take tests*



# Abundant Professionalism

- Hudson River landing (2009)
- Gliding to the Azores (2001)
- Sioux City (1989)
- Gimli Glider (1983)





# Lack of Professionalism

- Let's try FL 410 (2004)
- Takeoff without runway lights (2006)
- Stick shaker: PULL! (2009)
- Minneapolis over-flight (2009)

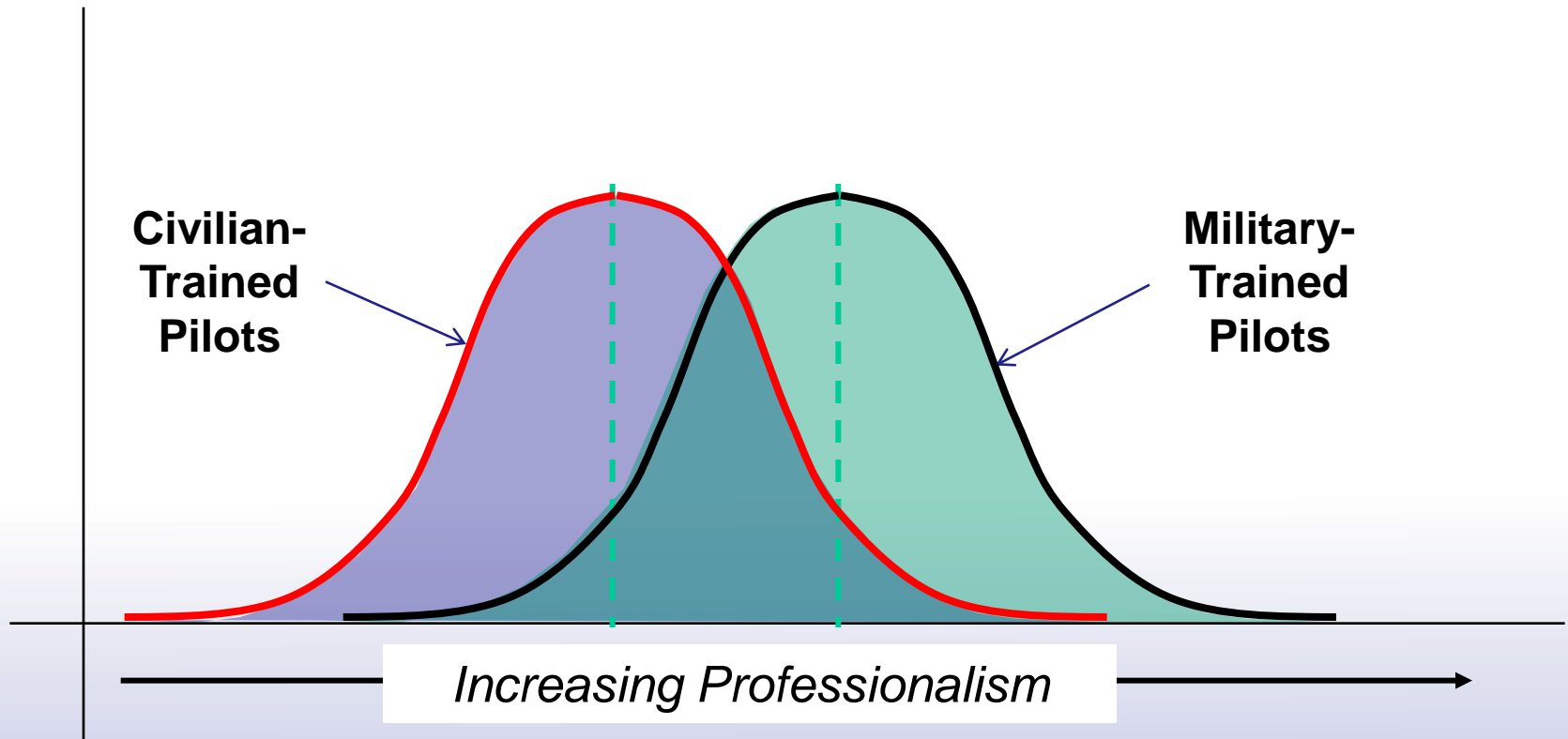


# The Training Challenge

- Initial training must:
  - Develop knowledge and skills
  - Be evaluated by more than just (eventually) passing knowledge and skill tests
  - Also develop and instill good judgment and professionalism
- Recurrent training must:
  - Continue to develop and strengthen all of the above



# Need to Shift the Bell Curve



# Criminalization

- Systems are getting more complex
- Most accidents involve good people trying to do the right thing
- Human error: Immediate response is to *PUNISH!*
- Issue: Best way to stop error that is *inadvertent?*



# Undesirable Results

Possibility of criminalization:

- Chills willingness of front-line employees to participate in proactive information programs
- Hinders mishap investigations
- Reduces likelihood of investigating or addressing system issues



# Recent Examples

- Concorde, Paris, France (2000)
- GOL 1907, Brazil (2006)
- Asiana 214, San Francisco (2013)?



# Concorde

## – Chain of Events

- Takeoff
- Piece of metal on runway from previous airplane
- Main gear tire shredded after hitting piece of metal
- Fragments from tire hit wing, punctured fuel tank
- Leaking fuel caught fire



# GOL 1907

## – Chain of Events

- Aircraft eastbound, FL 370, per international convention
- Assigned route turned westbound at navigation waypoint
- Go to even thousand (FL 380 or 360)?
- Pilots tried unsuccessfully to contact controllers, so remained at FL 370
- Transponder on “Standby” (for long time), hence
  - Airplane invisible to ATC
  - Airplane also invisible to TCAS in other airplanes
- Both airplanes navigating with GPS



## – Theory

- Pilot's foot on footrest hit transponder “Standby” button





# Automation

- Increasing complexity increases likelihood that operators will not completely understand the system
- Increasing reliability increases likelihood that operators have never seen a given malfunction before, even in training



# Examples

- Strasbourg, France (1992)
  - Cali, Colombia (1995)
- Amsterdam, Holland (2009)
  - Rio to Paris (2009)
- San Francisco (2013)?



# Strasbourg, France

- Risk Factors

- Night, mountainous terrain
- No ground radar
- No ground-based glideslope guidance
- No airborne terrain alerting equipment



- Very Sophisticated Autopilot

- Autopilot Mode Ambiguity



# Human Factors Challenge

- “3.2” in the window, *with a decimal*, means:
  - Descend at a 3.2 degree angle (about 700 fpm at 140 knots)
- “32” in the window, *without a decimal*, means:
  - Descend at 3200 fpm

***Clue: Quick Changes in Autopilot Mode  
Frequently Signal a Problem***

***Flight data recorder readout program could have  
helped safety experts identify this problem***



# Cali, Colombia

## – Risk Factors

- Night
- Airport in deep valley
- No ground radar
- Airborne terrain alerting limited to “look-down”
- Last minute change in approach
  - More rapid descent (throttles idle, spoilers)
  - Hurried reprogramming

## – Navigation Radio Ambiguity

## – Spoilers Do Not Retract With Power



# Recommended Remedies:

- Operational
  - *Caution re last minute changes to the approach!!*
- Aircraft/Avionics
  - Enhanced ground proximity warning system
  - Spoilers that retract with max power
  - Require confirmation of non-obvious changes
  - Unused or passed waypoints remain in view
- Infrastructure
  - Three-letter navigational radio identifiers
  - Ground-based radar
  - Improved reporting of, and acting upon, safety issues

*Note: All but **one** of these eight remedies address **system** issues*



# Amsterdam, Holland

## – The Conditions

- Malfunctioning left radar altimeter
- Pilots selected right side autopilot
- Aircraft vectored above glideslope
- Autothrust commanded throttles to idle
- Unknown to pilots, right autopilot using left radar altimeter
- Pilot unsuccessfully attempted go-around



## – Queries:

- Should autopilot default to same side altimeter?
- More clarity re source of information? Ability to select?



# Rio to Paris

## – The Conditions

- Cruise, autopilot engaged
- Night, in clouds, turbulence, coffin corner
- Ice blocked pitot tubes
- Autopilot and autothrust inoperative without airspeed
- Alpha protections disabled
- Pilots' responses inappropriate



## – Queries:

- Pilot training re loss of airspeed information in cruise?
- Importance of CRM – pilot knowing other pilot's actions?
- Pilot training re manual flight at cruise altitude?





# Conclusion

*In order to continue improving safety, the industry must address issues of professionalism, criminalization, and automation*



Thank You

***Questions?***



National Transportation Safety Board